

# Trauma Rounds

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## Management of Pelvic Fractures

DR. JAMES TATE:\* The case for today is that of a 45-year-old man who was injured when his motorcycle was struck by an automobile. On admission to hospital, his primary complaint was severe pain in the hip and pelvic area. There was no loss of consciousness at the scene of the accident and he was alert and oriented on arrival. The history was essentially noncontributory. On physical examination the patient was pale and diaphoretic. The blood pressure was 150/80 mm of mercury and pulse rate 80. Extremities were cool. No injuries were shown on examination of the head and neck area and the chest was clear to auscultation. Abdominal tenderness was noted, particularly in the suprapubic and pelvic area, and there were hypoactive bowel sounds. On rectal examination the prostate was noted to be free floating. The rectum was disrupted and there was blood on the examining finger. Blood was emerging from the urethra, and on insertion of a Foley catheter gross blood returned. There was full range of motion in all four extremities.

Intravenous pyelograms showed disruption of the bladder and total disruption of the urethra. Pelvic films showed fracture of the left acetabulum, disruption of the sacroiliac joint, separation of the symphysis pubis with craniad displacement

of the left hemi-pelvis. On exploratory laparotomy a large pelvic hematoma was observed but there were no other intraperitoneal lesions. A totally diverting descending colostomy and closure of the bladder injury were carried out. Suprapubic cystostomy was done and suprapubic drains and a pack were placed in the retrorectal area to control persistent diffuse hemorrhage. Following laparotomy, bleeding continued around the rectal packs and from the rectum.

Selective arteriograms of the pelvic vessels showed that the left internal pudendal artery was a major source of the hemorrhage. Autologous clot was injected down the angiographic catheter into the left pudendal artery and this controlled the bleeding. Additional treatment consisted of placing the patient in a pelvic sling.

The following day he was returned to the operating room and the rectal packs were removed. In the intensive care unit his cardiovascular status deteriorated, as manifested by a rising pulmonary artery wedge pressure, an increase in central venous pressure and a fall in urinary output. Because of this, cardiac glycosides were administered and the vital signs improved. The following day active bleeding again developed through the suprapubic drains. On repeat exploratory laparotomy the left hypogastric artery was ligated after autologous muscle had been injected into this vessel. There was no further bleeding from this area. Following this, cardiovascular instability

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and rising creatine and blood urea nitrogen were noted. This necessitated placement of a Scribner shunt and the use of hemodialysis. The clinical course then gradually improved, respiratory difficulties were minimal and good renal function returned by the end of the second week after trauma. At present, four weeks after injury, the patient's general condition is excellent. Bed rest is required for the unstable fractures, and the colostomy can be closed after the wounds are completely healed.

DR. THOMAS GADACZ:\* The immediate problem in this patient was control of the pelvic hemorrhage. At the time of the initial laparotomy the diffuse nature of the hemorrhage led us to attempt to control it with packs. When it persisted we used arteriograms to locate the bleeding points. The arteriograms showed persistent arterial bleeding in the left pelvic area. The vessel was identified as the internal pudendal artery. Autologous clot injected through the arteriogram catheter controlled this hemorrhage at first. However, it apparently disintegrated and the patient was returned to the operating room where autologous muscle was used to form an embolus in the left hypogastric artery. This controlled the pelvic hemorrhage.

DR. ROBERT C. LIM, JR.:† *I have the impression listening to this history that the patient was in compensated shock when he was admitted to the emergency room. Is that correct, Dr. Gadacz?*

DR. GADACZ: Yes. During laparotomy we found approximately a six-unit retroperitoneal hematoma in addition to the external blood loss through the rectum.

DR. DONALD TRUNKEY:‡ I think that this illustrates one of the main problems in management of the pelvic fracture. The pelvic fracture can be a source of considerable loss of blood into the retroperitoneum, thighs and buttocks with no overt manifestation on physical examination. In addition, there may be intraperitoneal bleeding from the pelvic vessels or from associated injury of intra-abdominal organs. For this reason, exploratory laparotomy is usually necessary in extensive injuries of this type to make sure that all overt bleeding is controlled. Disruption of the rec-

tum and the bladder in this patient were additional indications for laparotomy.

Specific comments about this patient's injuries include the following: The retroperitoneal space is relatively avascular and fecal contamination here may cause local infection and ultimately may cause fatal sepsis. The management should consist of a completely diverting colostomy, wide drainage of the retrorectal space and irrigation of the distal rectal segment to remove all fecal contents. There is also clear indication for treating the patient with antibiotics in this situation. These are not prophylactic antibiotics, since the space is already contaminated—almost certainly infected. I favor the use of limited spectrum antibiotics as opposed to broad spectrum antibiotics which may select out resistant organisms which then can cause complicated lethal infections. High doses of penicillin are my treatment of choice and I would give 30 million units of aqueous penicillin daily.

To treat the patient's bladder injury, a two or three layer closure of the injury itself is indicated. In addition, decompression of the bladder with a suprapubic cystostomy is mandatory. Again, drains must be placed around the suprapubic area. Insertion of a Foley catheter in the urethra is essential to provide further drainage and maintain continuity of the lower genitourinary tract while healing occurs.

There has been considerable controversy as to how best to handle pelvic bleeding, which can be quite massive. Some investigators have advocated exploring all pelvic hematomas. However, most pelvic hemorrhages are venous in origin and are difficult or impossible to control, particularly since most of the vessels retract into bony structures. In addition venous bleeding can usually be easily tamponaded, especially if it is contained by the intact peritoneum. The policy that has been adopted at this hospital, therefore, is not to explore pelvic hematomas unless they are expanding or pulsatile. If hemorrhage persists, the following program should be carried out: A panel of coagulation tests should be obtained, including prothrombin time, partial thromboplastin time and a study of the platelets both on a quantitative and qualitative basis. If medical bleeding is the problem, then appropriate therapy should be given such as platelet packs, fresh frozen plasma or fresh warm whole blood.

If bleeding is not of a nature controllable by medical means, then selective angiography is called

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for. This will show the site of arterial bleeding in the minority of patients in which this is the source of hemorrhage. In such a case, two choices are open. Autologous clot injected through the catheter may be used to form an embolus. Or, if the bleeding vessel is too large for this to be practical, direct exploration and ligation or repair of the vessel is warranted.

Using these criteria for exploration of the pelvic hematoma, we have had only two patients in a series of over 200 cases of pelvic fractures in the last three years who bled to death from a pelvic injury. It should be pointed out that we have not found hypogastric artery ligation in itself effective in managing pelvic bleeding because of the extensive collaterals that pelvic vessels have. It may be beneficial, however, when autologous muscle is used to form an embolus in the vessel.

Dr. Chapman, you have had considerable experience with management of pelvic fractures. What are your comments regarding this particular patient?

DR. MICHAEL CHAPMAN:\* It is interesting that the cause of injury in this patient was similar to that of four other patients we have seen at this hospital recently. All four of these patients also were motorcycle riders who were involved in accidents. What appears to happen is that as the motorcycle strikes an object, the handlebar pins the leg at the groin and the victim's forward motion continues. The handlebar may actually impale the patient in the anterior perineum. With the leg trapped and the patient continuing forward, the pubic symphysis separates, producing an open-book fracture of the pelvis with disruption of the sacro-iliac joint. This patient had an acetabular fracture in addition so that the leg was almost wrenched off. Two of the other patients had a traumatic hemipelvectomy with skin and some muscle still attached.

We have recently reviewed pelvic fractures at this hospital and have devised a classification for these injuries. Its object is to enable us to examine a fracture and make some decision about prognosis, ultimate blood loss and possible injuries to associated organs as well as determining whether the fracture is stable or unstable. Unstable fractures usually require some immobilization which may interfere with pulmonary management.

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TABLE 1.—Classification of Pelvic Fractures

- I. Comminuted (Crush) Injuries
  - Three or more major components involved (rami, ilium, acetabulum, sacrum)
  - Often unstable
  - Usually are combinations of II—A, B, C, D
- II Unstable (Require immobilization or traction to reduce hemorrhage or maintain position of weight bearing portions of pelvis.)
  - A. Diametric fractures with cranial displacement of hemipelvis (Froman and Stein, 1967; Malgaigne, 1847)
  - B. Diametric fractures, undisplaced
  - C. Open-book (sprung) pelvis
  - D. Acetabular fractures
- III. Stable (Immobilization usually unnecessary except for symptomatic relief.)
  - A. Isolated fractures
  - B. Fractures of the pubic rami

TABLE 2.—Relation of Type of Pelvic Fracture to Mortality and Morbidity

	No.	Mortality	Morbidity	Respiratory Distress Syndrome
Type I ...	23	5(21.7%)	16(69.5%)	8(34.7%)
Type II ...	61	7(11.4%)	28(45.9%)	13(19.4%)
Type III ...	89	4 (4.5)%	27(30.3%)	7 (7.8%)

Therefore we have proposed three major types of fractures (Table 1). First is the *type I* or crush injury. This is a fracture that involves three or more of the major components of the pelvis: the pubic rami, the ilium, the acetabulum, and the sacrum and sacro-iliac joints. These fractures are usually unstable and are combinations of the various type II injuries. *Type II* fractures are unstable and have four subgroups. Type II A and B are the displaced and undisplaced Malgaigne fracture. This kind of fracture is usually due to falls. The pelvis on one side is driven cephalad, resulting in a vertical fracture through the anterior and posterior elements of one side of the pelvis. Type II C is the open-book fracture. Type II D is any fracture involving the acetabulum. *Type III* fractures are stable and usually are of little concern in the patient with multiple injuries. They are isolated fractures of the pubic rami, iliac crest or acetabulum. Our patient had a class II C pelvic fracture with tremendous associated soft tissue injury. With the acetabular fracture it could be considered a type I.

Types I and II have the greatest associated incidence of pulmonary complications and blood loss (Table 2). Mortality in this hospital and in most series is 22 percent for type I, 11 percent

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for type II and 4.5 percent for type III injuries. Much of the mortality relates to the magnitude of the soft tissue injuries and to the severe associated injuries.

The stable fractures do not require any specific treatment. As soon as the acute pain and discomfort have subsided, ambulation can be begun. Type I and types II A, B and C are best treated with a pelvic sling and type II D may require skeletal traction on the femur in addition. All have a good prognosis for healing. After four weeks, stability is generally satisfactory enough that pelvic traction can be discontinued and ambulation begun a week or two afterward.

**DR. TRUNKEY:** In summary, the principles which we wish to emphasize in this case are as follows. Pelvic fractures can be classified into three types. The stable or type III fracture involving one element of the pelvic ring has a good prognosis. The unstable type I and II injuries are fractures caused

by great violence. Soft tissue injury is extensive and severe associated injuries are frequent in the type I and II injuries, with associated bleeding often a problem. Laparotomy usually is indicated to control the intraperitoneal hemorrhage or treat associated organ injury. Hematomas that are not pulsatile or expanding usually are venous in origin and are best treated by leaving the peritoneum intact so that tamponade will stanch bleeding. If there is evidence of continuing hemorrhage following initial treatment, then medical causes of continued hemorrhage should be ruled out or treated. At this point, arteriography can be of great help in determining the site of major bleeding points. Definitive ligation of the specific vessel, if large, or catheter embolism, if small, should control the hemorrhage. If bleeding is diffuse and uncontrollable by any other means, judicious placement of packs may be necessary. These should be removed after 24 hours if possible to avoid septic complications.